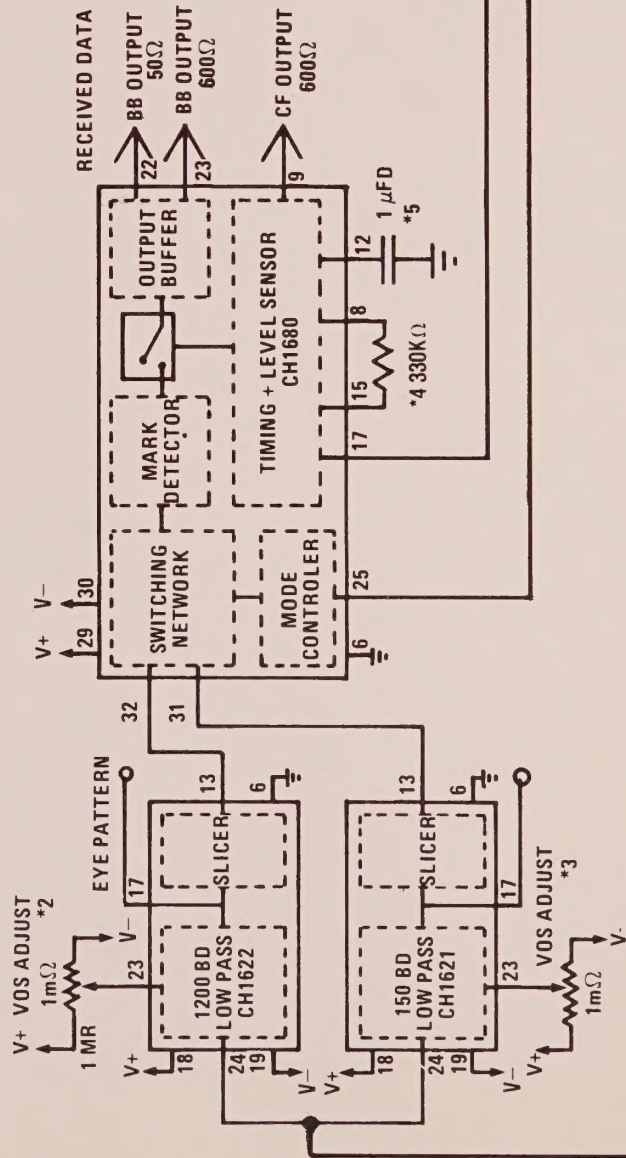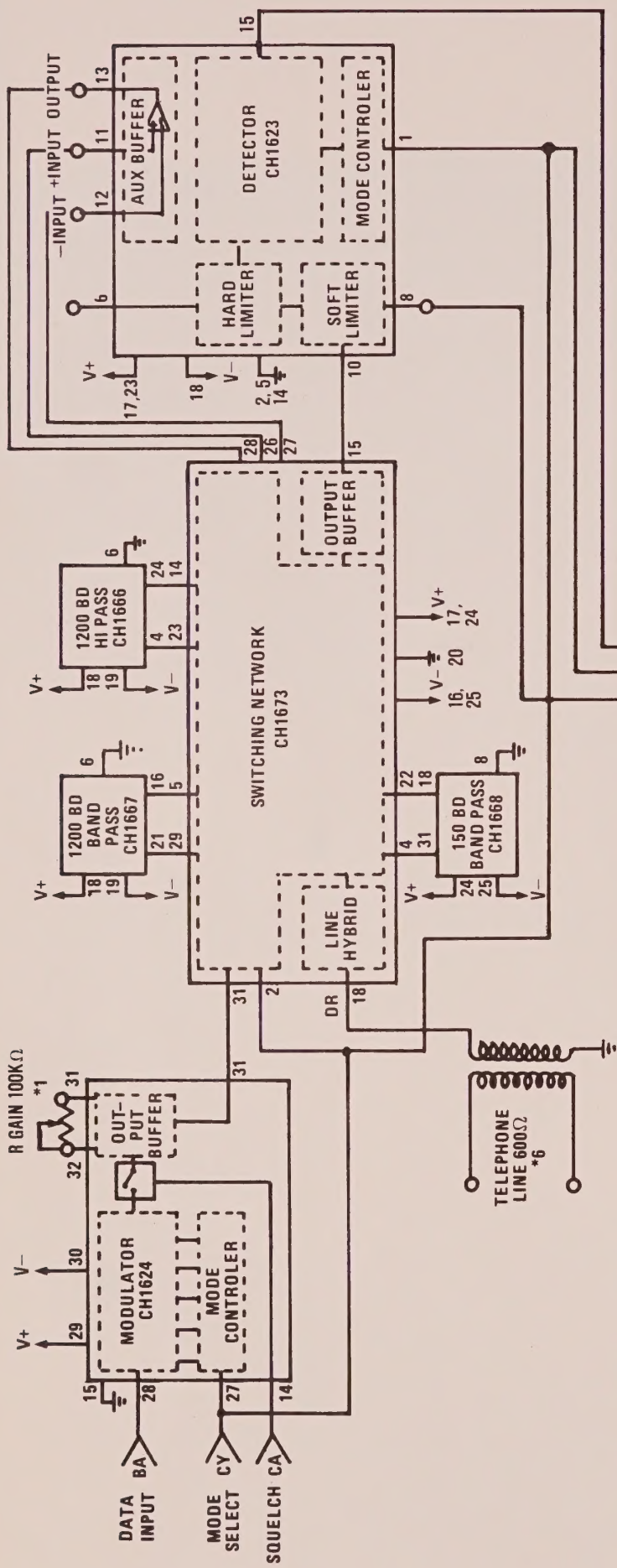# ꜰCermetek
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202/CCITT 1200 BAUD
MODULAR MINIMODEM™

ꜰCermetek
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™ MINIMODEM IS A CERMETEK TRADEMARK

NOTES: EXTERNAL COMPONENTS

*1 R GAIN 100KΩ, FOR SETTING OUTPUT AMPLITUDE OF MODULATOR

*2 } VOS ADJ 1 MegΩ, FOR MINIMIZING BIAS DISTORTION
*3 }

*4 330K, HYSTERESIS ADJUSTMENT FOR RECEIVE LEVEL

*5 1 MICROFARAD TIMING CAPACITOR FOR TURN ON AND TURN OFF

*6 600Ω to 600Ω COUPLING TRANSFORMER

NOTES: POWER SUPPLY REQUIREMENTS

*ALL MODULES OPERATE ON ± 12 VOLTS AND GND, TO ± 16 VOLTS AND GND.

AUX BUFFER

DETECTOR CH1623

MODE CONTROLER

HARD LIMITER

SOFT LIMITER

−INPUT +INPUT OUTPUT

OUTPUT BUFFER

SWITCHING NETWORK CH1673

1200 BD HI PASS CH1666

1200 BD BAND PASS CH1667

LINE HYBRID

150 BD BAND PASS CH1668

R GAIN 100KΩ *1

OUTPUT BUFFER

MODULATOR CH1624

MODE CONTROLER

DATA INPUT BA

MODE SELECT CY

SQUELCH CA

TELEPHONE LINE 600Ω *6

RECEIVED DATA

BB OUTPUT 50Ω

BB OUTPUT 600Ω

CF OUTPUT 600Ω

OUTPUT BUFFER

MARK DETECTOR

TIMING + LEVEL SENSOR CH1680

1 µFD *5

*4 330KΩ

SWITCHING NETWORK

MODE CONTROLER

EYE PATTERN

SLICER

1200 BD LOW PASS CH1622

SLICER

150 BD LOW PASS CH1621

V+ VOS ADJUST *2

VOS ADJUST *3

1 MR

1mΩ

202 CCITT ANSWER/ORIGINATE MODEM

1200 BAUD MODEM

Features:

1. Asynchronous
2. FSK Modulation
3. Phase Coherency
4. 1200 Baud Forward Channel
5. 150 Baud Backward Channel
6. Originate—Answer, Originate or Answer
7. Full Duplex
8. 1800 Baud Forward Channel on Conditioned Line
9. CCITT RS232
10. Serial Data
11. Binary
12. Switch or Leased Lines
13. Automatic or Manual
*14. 1300Hz - 2100Hz Forward Channel
15. 387Hz - 487Hz Backward Channel
16. Dial-up Lines
17. Size: 5 x 6 inches on PC board
18. Operating temperature: 0°-70°C
19. 2 or 4 Wires
20. Receive Sensitivity: −45dB Adjustable
21. Frequency Tolerance: ± 10Hz
22. Carrier Delay: 1) Operate for 40ms ± 20ms
          2) Release for 12ms ± 6ms
23. Dynamic Range 45dB
24. Transmitter Output Level is Adjustable
25. Transmitter Output Impedance is 600Ω
    ± 10% (Line Hybrid)
26. PP jitter 8% (worst case)
27. Supply Voltage: ± 12V to± 16V
28. Storage Range: −55°C to +125°C

INTRODUCTION

Modems have been used for transmitting data over a variety of telephone networks ranging from unconditioned lines to conditioned leased lines. Additional circuitry is added to the modem to maintain control of the data channel during connect and disconnect as well as during data transmission. The total circuit is called a data set.

Data Format	Forward Channel - to 1200 BPS Serial Binary Asynchronous Reverse Channel - to 150 BPS Serial Binary Asynchronous
Operation	Full Duplex over Switched Telephone Line
Modulation	Phase Coherent FSK
Frequency Tolerance	± 10Hz Max
Transmitter Out	600Ω
Transmitter Output Level	User Adjustable
Receiver Dynamic Range	45dB
Bit Error Rate	1×10^{-5} at 3dB signal to noise ratio
PP Jitter	8% Max
Receive Clamp	Held at "MARK" until Carrier Detector is in "ON" condition
Carrier Detect & Threshold	ON at −43 DBM, OFF at −48 DBM
Carrier Detect & Timing	OFF to ON 40ms ± 20ms, ON to OFF 12ms ± 6ms
Data Control Interface	RS232C
Minimum Supply Voltage	± 12 volts
Maximum Supply Voltage	± 16 volts
Power Consumption	4.2 Watts at ± 12 volts
Operating Temperature	0° to 70°C

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miniModem™
Modular Modem Building Blocks Design Data

Cermetek's unique approach to the packaging of standard building blocks for the 202 Modem applications provides the circuit designer with a much greater degree of flexibility in implementing his data transmission requirements. The "mini-Modem" building block approach is based on 11 standard module types: Modulator CH1624, Demodulator CH1623, Switching Network/Line Hybrid CH1673, 1200 Baud Lowpass CH1622, 150 Baud Lowpass CH1621, 1200 Baud Bandpass CH1667, 1200 Baud Additional Highpass CH1666, 150 Baud Bandpass CH1668, and Carrier Detector CH1680, Answer Only Interconnect CH1672, Originate Only Interconnect CH1671.

With combinations of some or all of these modules and some simple interface circuitry the designer can assemble a full line of CCITT compatible 202 series data sets as well as many custom configurations.

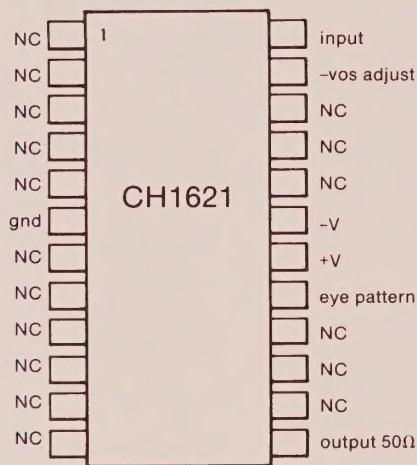*Special passband characteristics allow Bell frequencies compatibility while using CCITT center frequencies.

CH1621
Lowpass-Slicer Backward Channel

The CH1621 is a 150Hz lowpass that rejects the carrier related information, allowing the intelligence information to be seen as the "EYE" pattern. The eye pattern is restored to the digital RS232 levels by a 0 volt cross-over detector with an output impedance of approximately 50Ω. Offset adjustments can be done by using a 1 meg Ω pot across the ± 12V supply connecting the center tap to pin 23. The eye pattern is used to help evaluate system performance.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
3dB Bandwidth		165		Hz
Carrier Suppression		−45		dB
Power Consumption		400		mW
Operating Temperature	0		70	°C

CH1621 pinout:
NC — input (pin 1 side)
NC — -vos adjust
NC — NC
NC — NC
NC — NC
gnd — -V
NC — +V
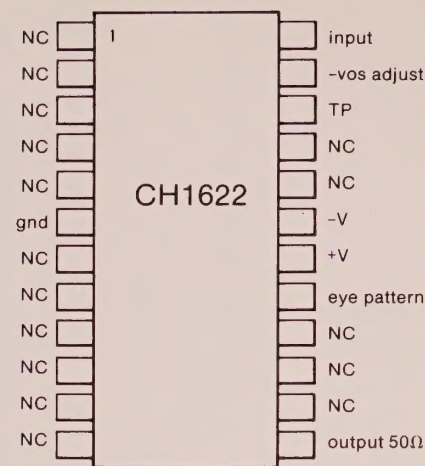NC — eye pattern
NC — NC
NC — NC
NC — NC
NC — output 50Ω

CH1622
Lowpass-Slicer - Forward Channel

The CH1622 is a 900Hz lowpass that rejects the carrier related information, allowing the intelligence information to be seen as the "EYE" pattern. The eye pattern is restored to the digital RS232 levels by a 0 volt cross-over detector with an output impedance of approximately 50Ω. Vos adjustments can be done by using a 1 m Ω pot across the ± 12V supply, connecting the center tap to pin 23. The eye pattern may be used to help evaluate system performance.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
3dB Bandwidth	850	900	950	Hz
Carrier Suppression		55		dB
Power Consumption		120		mW
Operating Temperature	0		70	°C

NB: TP denotes factory manufacturing test points.

CH1622 pinout:
NC — input
NC — -vos adjust
NC — TP
NC — NC
NC — NC
gnd — -V
NC — +V
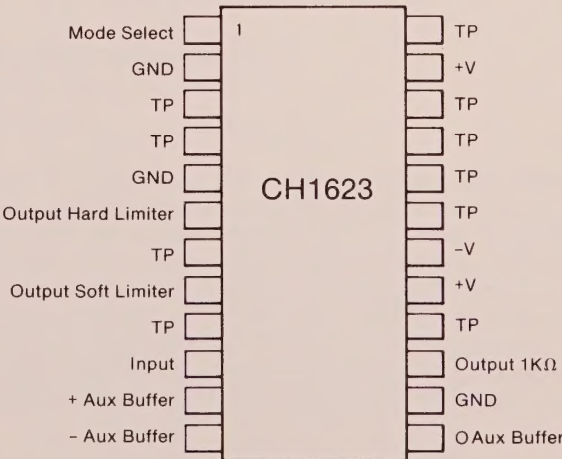NC — eye pattern
NC — NC
NC — NC
NC — NC
NC — output 50Ω

CH1623
Demodulator

The CH1623 is a high performance FSK demodulator designed to detect data rates to 1800 baud. Also included is the necessary circuitry to change the detector from forward channel to reverse channel with simple RS232 logic. An additional buffer is brought out for use as a line hybrid in originate only or answer only modes.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Sensitivity	−45			dBm
Dynamic Range	45			dB
Data Rate		1200	1800	Bits/Sec.
Jitter			8	% P-P
Bit Error Rate*		1×10^{-5}		Error/Bits
Channel Select Voltage		RS232		Volts
Power Consumption		1.56		W
Operating Temperature	0		70	°C

*At 3dB signal to noise ratio

CH1623 pinout:
Mode Select — TP (pin 1 side)
GND — +V
TP — TP
TP — TP
GND — TP
Output Hard Limiter — TP
TP — -V
Output Soft Limiter — +V
TP — TP
Input — Output 1KΩ
+ Aux Buffer — GND
- Aux Buffer — O Aux Buffer

CH1624
Modulator

It is a thick film hybrid voltage controlled oscillator designed for 202 type FSK applications. This device is a fixed* tone generator for CCITT frequencies. The package incorporates all of the necessary logic to switch modes as well as mark and space frequencies with simple RS232 type logic levels on CY and BA.

Other features of this modulator include squelch, which enables a complete isolation of the modulator from the buffer without direct oscillator suppression. The squelch is used in the hand-shake routine to stop the transmission of data.
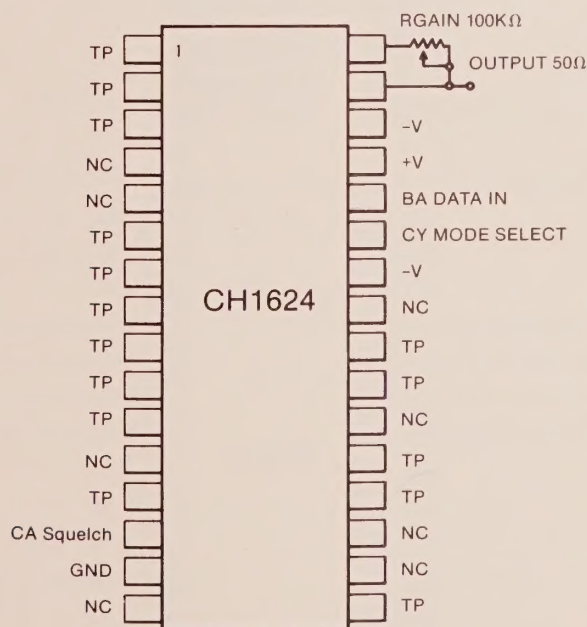
Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Frequency Range*	.3		5.0	KHz
Output Voltage Level			± 14	V P-P
Second Harmonic Dist.		2.5	5	%
Data Input Limits		RS232		Volts
Frequency Tolerance		± 10		Hz
Power Consumption		120		mW
Operating Temperature	0		70	°C

	Frequency	CY	BA
Forward Mark	1300	1	1
Channel Space	2100	1	0
Backward Mark	387	0	1
Channel Space	487	0	0

* The internal frequency determining network can be modified to accomodate customer requirements (300Hz to 5KHz).

CH1666
1200 Baud Highpass Filter, Forward Channel

The CH1666 is a high performance highpass filter that when used with the CH1667 bandpass will have magnitude and delay equalization for the 3002 unconditioned line. In this configuration 45 dB of adjacent channel rejection is acheived.
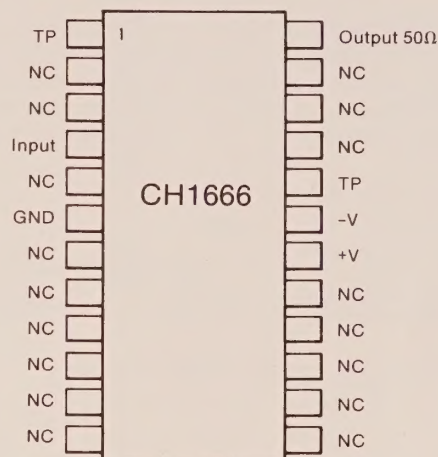
NB: TP denotes factory manufacturing test points.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Highpass Gain at 1700Hz		-5		dB
Highpass Ripple*		± .6		dB
3dB Frequency		1025		Hz
Group Delay Variation*		14.4		μS
Output Voltage Swing			± 11	Volts
Power Consumption		330		mW
Operating Temperature	0		70	°C

* This is designed with pre-emphasis for a 3002 conditioned line.

CH1667
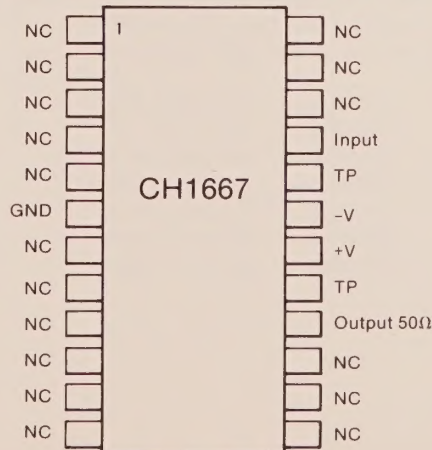### 1200 Baud Bandpass Filter Forward Channel

The CH1667 is a high performance bandpass filter that will function as both transmit and receive filters. When used with the CH1666 highpass filter, the combination becomes a high performance 1200 baud receive filter with 45dB of reverse channel rejection with delay and magnitude equalization for the 3002 unconditioned line.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Center Frequency		1700		Hz
Bandpass Gain at Center Frequency		17		dB
Bandpass Ripple*		± 2		dB
Output Voltage Swing		± 10		Volts
Group Delay Variation*		43		μS
3dB Bandwidth		1.36		KHz
Adjacent Channel Rejection		−45		dB
Power Consumption		360		mW
Operating Temperature	0		70	°C

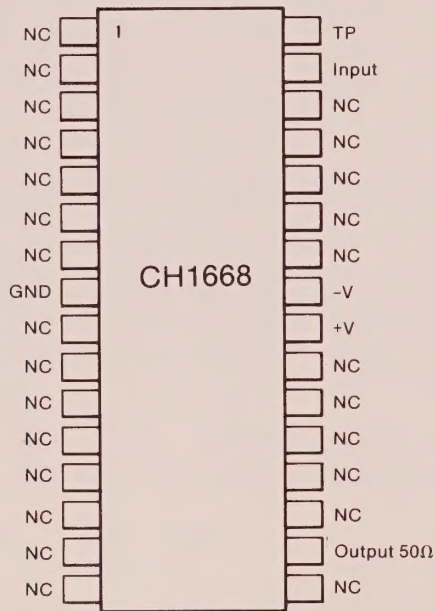* This is designed with pre-emphasis for a 3002 conditioned line.

CH1668
150 Baud Bandpass Filter, Backward Channel

The CH1668 is a high performance bandpass filter that will function as both transmit and receive filters. this filter will provide a minimum of 45dB of adjacent channel rejection.

Operating Characteristics
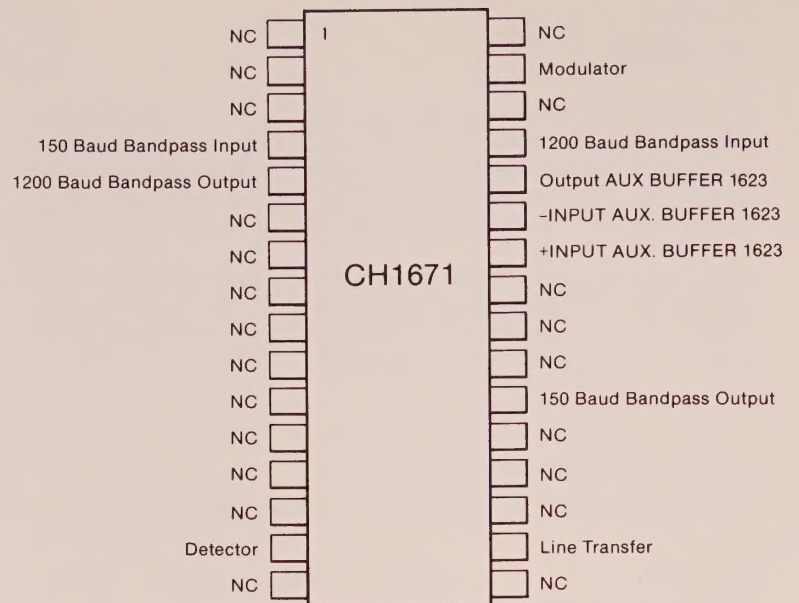### Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Center Frequency		430		Hz
Bandpass Gain at Center Frequency		12		dB
Bandpass Ripple		± 1.5		dB
Output Voltage Swing		± 10		Volts
3dB Bandwidth		225		Hz
Center Frequency Gain		7		dB
Adjacent Channel	−45			dB
Group Delay Variation		198		μS
Power Consumption		480		mW
Operating Temperature	0		70	°C

CH1668 pin diagram:

Left side (top to bottom): NC, NC, NC, NC, NC, NC, NC, GND, NC, NC, NC, NC, NC, NC, NC, NC

Right side (top to bottom): TP, Input, NC, NC, NC, NC, NC, −V, +V, NC, NC, NC, NC, NC, Output 50Ω, NC

CH1671
Originate Only Interconnect

The CH1671 is a passive interconnect replacement for the CH1673. It allows the user to use the same PC board for answer/originate, or just originate only. The other modules needed for a high performance originate only modem are:
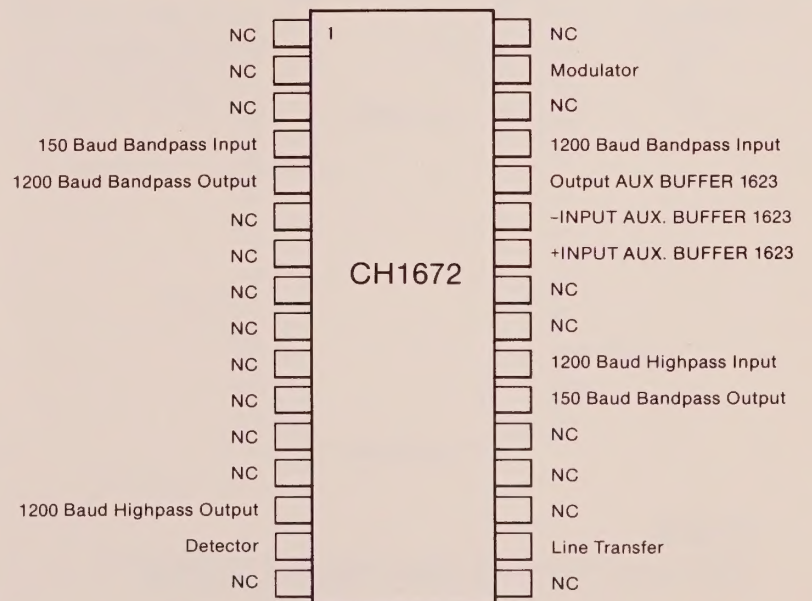
CH1621	Lowpass Slicer
CH1623	Detector
CH1624	Modulator
CH1667	Transmit Filter
CH1668	Receive Filter
CH1671	Interconnect
CH1680	Carrier Detect

CH1671 pin diagram:

Left side (top to bottom): NC, NC, NC, 150 Baud Bandpass Input, 1200 Baud Bandpass Output, NC, NC, NC, NC, NC, NC, NC, NC, Detector, NC

Right side (top to bottom): NC, Modulator, NC, 1200 Baud Bandpass Input, Output AUX BUFFER 1623, −INPUT AUX. BUFFER 1623, +INPUT AUX. BUFFER 1623, NC, NC, NC, 150 Baud Bandpass Output, NC, NC, NC, Line Transfer, NC

CH1672
Answer Only Interconnect

The CH1672 is a passive interconnect replacement for the CH1673. It allows the user to use the same PC board for answer/originate, or just answer only. The other modules needed for a high performance answer modem only are:

CH1622	Lowpass Slicer
CH1623	Detector
CH1624	Modulator
CH1666	Receive Filter
CH1667	Receive Filter
CH1668	Transmit Filter
CH1672	Interconnect
CH1680	Carrier Detect

CH1672 pin diagram:

Left side (top to bottom): NC, NC, NC, 150 Baud Bandpass Input, 1200 Baud Bandpass Output, NC, NC, NC, NC, NC, NC, NC, NC, 1200 Baud Highpass Output, Detector, NC

Right side (top to bottom): NC, Modulator, NC, 1200 Baud Bandpass Input, Output AUX BUFFER 1623, −INPUT AUX. BUFFER 1623, +INPUT AUX. BUFFER 1623, NC, NC, 1200 Baud Highpass Input, 150 Baud Bandpass Output, NC, NC, NC, Line Transfer, NC

NB: TP denotes factory manufacturing test points.

CH1673
## Mode Selector, Switching Interconnect

The CH1673 is a FET switching network designed to switch in and out appropriate bandpass filters for dual mode operation. This incorporated with the line hybrid simplifies full duplex modem application.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

Parameter	Min.	Typ.	Max.	Units
Line Hybrid				
Line Impedance		600		Ω
Voltage Gain Line				
to Receiver		6		dB
Voltage Loss Transmitter				
to Receiver	10			dB
Isolation Transmitter				
to Receiver*	10			dB
Switching Network				
R on		50		Ω
R off		10		MΩ
Mode Select Voltage		RS232		Volts
Power Consumption		360		mW
Operating Temperature	0		70	°C

* Isolation is a function of line mismatch from 600Ω specified for 30% mismatch.
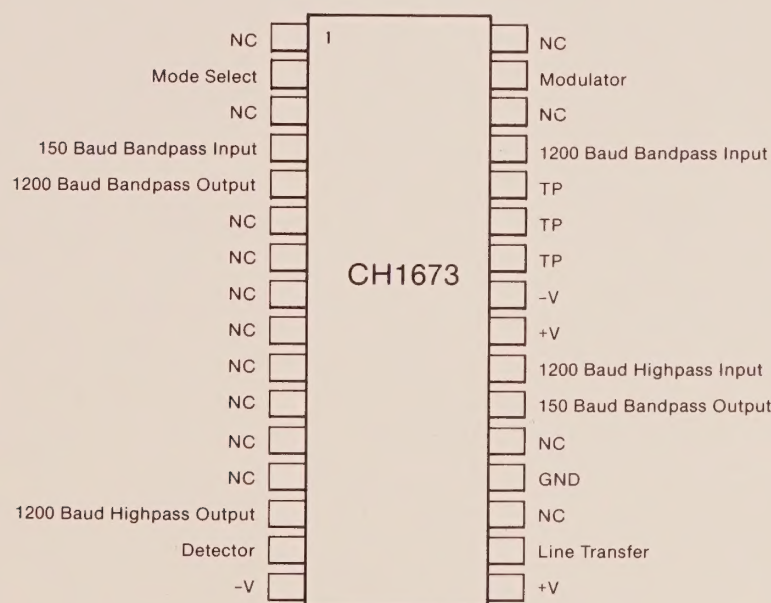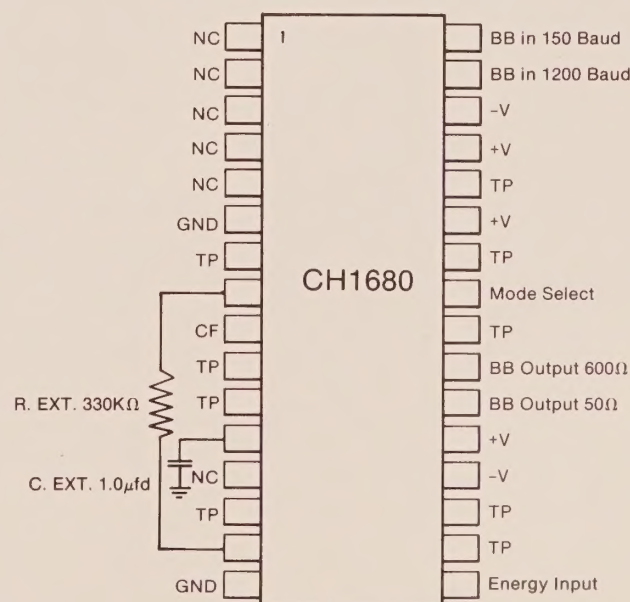

CH1680
Carrier Detector

The CH1680 provides a carrier detect function compatible with the 202 series modem modules. The CH1680 consists of a level detector, "MARK" detector and timer. The "MARK" detector monitors the output of the lowpass filter, while the level detector measures signal level at the CH1623 soft limiter output. A steady mark condition, and signals greater than threshold, will start the timer. If this condition is met for 40mS, CF will go to the "ON" condition and the part will unsquelch allowing BB to be seen at the output.

Reduction of the signal level to −48dB for 12mS returns the output to squelched, "OFF" condition, where upon as steady mark and proper signal levels are again required. Threshold level, timing intervals and hysteresis may be varied from nominal to suit individual design requirements.

Operating Characteristics
Test Conditions V+, +12V; V−, −12V; TA = 25°C

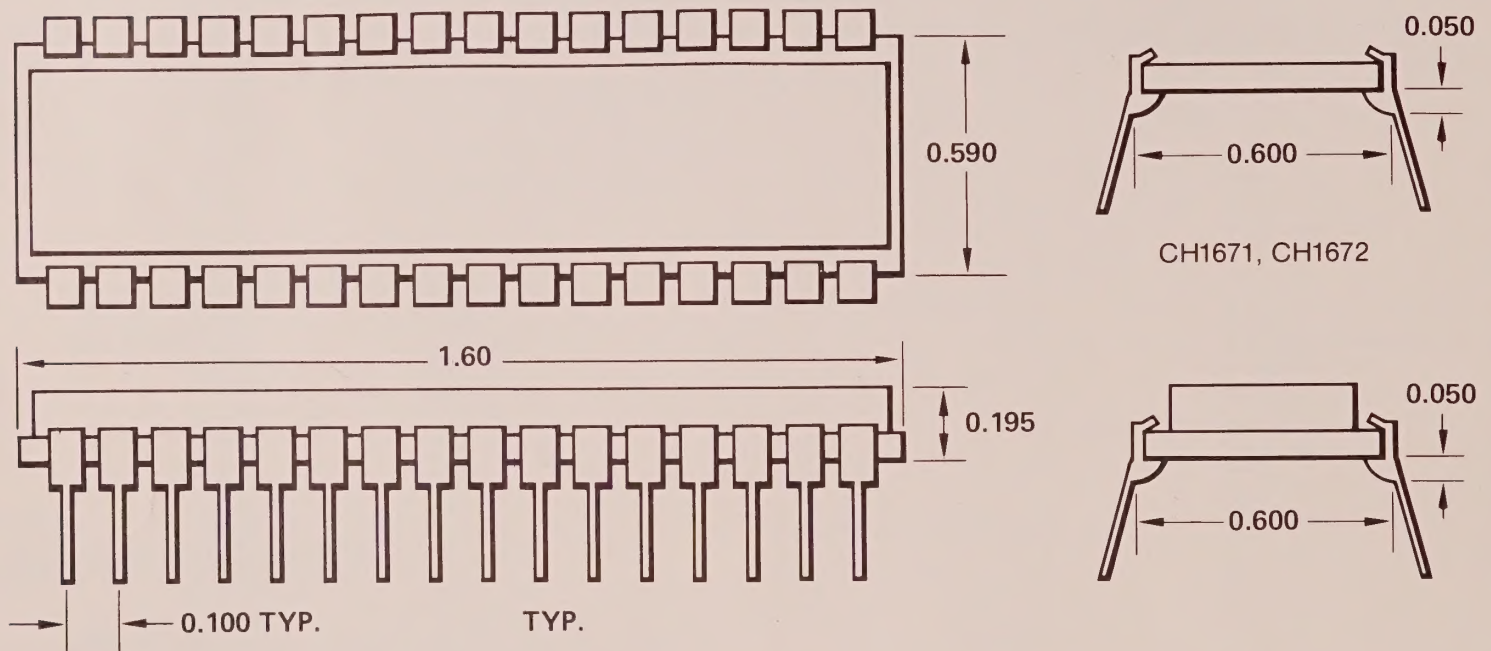| Parameter	Min.	Typ.	Max.	Units
Carrier Level				
Off to On		−43		dB
On to Off		−48		dB
Timing				
Off to On	20	40	60	mS
On to Off	6	12	18	mS
Output Level CF				
Off	−8	−10		Volts
On	+8	+10		Volts
Z out BB (pin 22)		50		Ω
Z out BB (pin 23)		600		Ω
Power Consumption		850		mW
Operating Temperature	0		70	°C

NB: TP denotes factory manufacturing test points.

Physical Dimensions
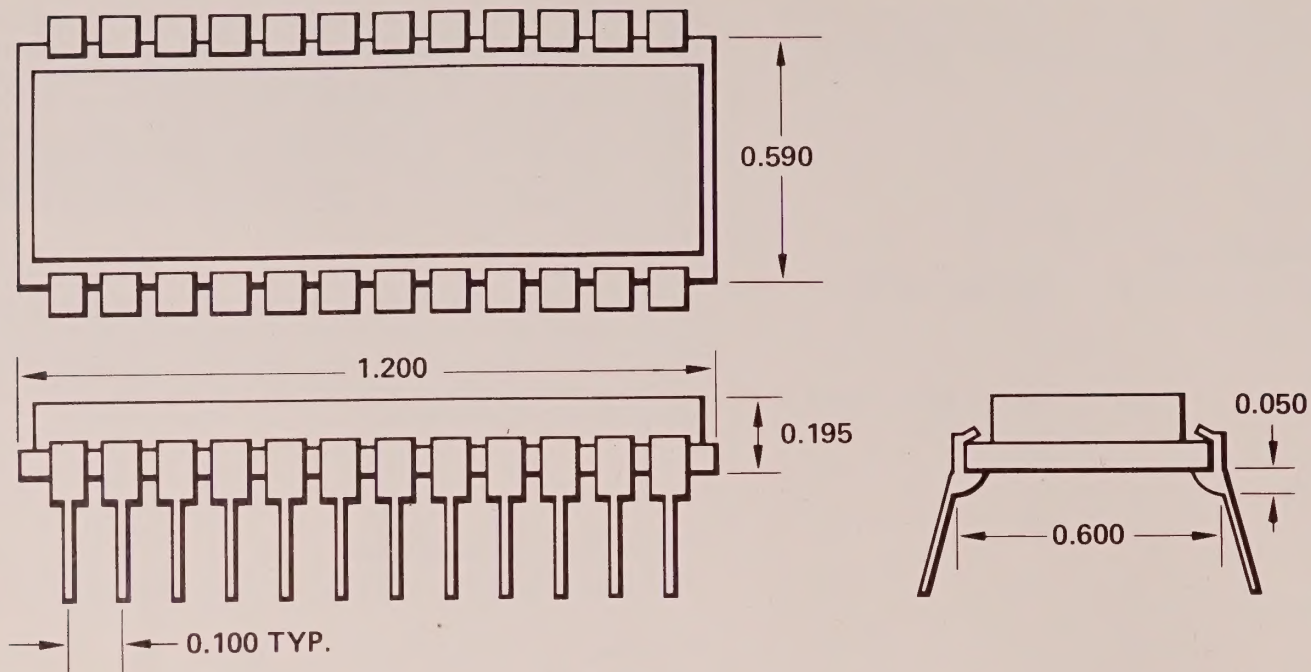
CH1621, CH1622, CH1623, CH1666, CH1667

CH1671, CH1672

CH1624, CH1668, CH1673, CH1680

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